Food Irradiation– An Update

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Irradiation, a process that exposes products to ionizing radiation, can control or reduce microbial pathogens (illness-causing bacteria, parasites, and fungi) and can extend the shelf-life for some perishable food products, such as potatoes and strawberries. In the United States, irradiation is approved to control insects in foods, delay ripening and sprouting in fresh fruits and vegetables, decontaminate spices and dried vegetable seasonings, and control or reduce foodborne pathogens in pork and poultry.

Use of irradiation on foods requires approval by the U.S. Food and Drug Administration (FDA). USDA's Food Safety and Inspection Service (FSIS) must also grant approval for meat and poultry uses. Federal regulators have so far approved two uses of irradiation for meat and poultry: inactivating *Trichinella spiralis* (the parasite responsible for causing trichinosis) in fresh or previously frozen pork and controlling such pathogens as *Salmonella* in uncooked poultry. In December 1997, FDA approved irradiation for red meat (such as beef and lamb) to control foodborne pathogens and extend shelf life. In February 1999, USDA proposed allowing the irradiation of raw meat and raw meat products; a final rule will be published after incorporating public comment.

Under USDA's proposal, irradiation would be permitted to treat refrigerated or frozen uncooked meat and some meat products. USDA's proposal stipulates that irradiation of meat will be voluntary—no meat processor would be required to use the process.

The proposed rule requires that irradiated meat and meat products bear the radura symbol (fig. 1) and a statement indicating that the product was treated by irradiation. For unpackaged meat products, the statement and logo must be conspicuously displayed to purchasers. USDA is also proposing that irradiated meat used as an ingredient in a food product be listed as such in the listing of ingredients.

Figure 1
Radura Symbol

A Look at Benefits and Costs

While complete estimates of the costs and benefits of irradiation are not available, a 1997 *FoodReview* article examined the effects of irradiating ground beef for pathogen control. This study by USDA's Economic Research Service (ERS) estimated the medical costs and productivity losses related to two foodborne illnesses, salmonellosis and *E. coli* O157:H7 disease, associated with ground beef, as well as industry costs of irradiating ground beef. These estimates have now been updated using more recent, higher estimates of the number of illnesses from ground beef-related *E. coli* O157:H7 disease.

Estimated net social benefits (benefits minus costs) depend on the cost of irradiating ground beef and the extent of the foodborne illness prevented. If 25 percent of the 7 billion pounds of ground beef consumed in the United States were irradiated, and this treatment successfully prevented 25 percent of foodborne illnesses from *Salmonella* and *E. coli* O157:H7 in ground beef, ERS researchers estimate the net annual benefits would range from

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Table 1
Net Benefits of Irradiating Ground Beef Depend on Cost[1]

Assumed cost per pound to irradiate	Range of estimated social benefits[2]	Estimated industry costs	Range of estimated net benefits[2]
Cents	*Million 1996 dollars*		
1.6	31.8 to 203.1	28.6	3.2 to 174.5
5	31.8 to 203.1	89.3	-57.5 to 113.8

[1]Benefits and costs are in 1996 dollars and also differ from previous ERS estimates because of new data on *E. coli* O157:H7 illnesses and deaths and 1996 data on U.S. ground beef supply. Table assumes that by irradiating 25 percent of the U.S. ground beef supply, 25 percent of foodborne illnesses from *Salmonella* and *E. coli* O157:H7 in ground beef would be prevented. [2]Range is due to the uncertainty in the annual number of foodborne illnesses and the method used to value premature deaths.

-$57.5 million to $174.5 million in 1996 dollars.

Raw foods of animal origin, such as meat, poultry, seafood, dairy products, and eggs, are the most likely to carry pathogens. Ground beef poses higher food safety risks than other cuts of beef because the grinding process spreads any pathogens that may be present on the surface of the meat throughout the ground beef. An individual hamburger patty may contain meat from many cattle, increasing the risk of contamination. If the hamburger patty is insufficiently cooked, pathogens in the middle of the patty can survive. Whether a consumer gets sick depends on a number of factors, including the type and number of pathogens ingested and the health of the individual.

Data from the U.S. Centers for Disease Control and Prevention (CDC) indicate that about 49 percent of the annual cases of *E. coli* O157:H7 disease (or 9,800 to 19,600 cases) are due to consumption of insufficiently cooked ground beef. USDA estimates that roughly 3 percent of the annual cases of salmonellosis (or 23,200 to 116,000 cases) are attributed to the same cause. The annual medical costs and productivity losses from consuming ground beef tainted with *Salmonella* or *E. coli* O157:H7 was estimated between $127 million and $812.2 million. Costs varied depending on estimates of annual cases.

If 25 percent of the U.S. ground beef supply were irradiated at a cost of 1.6 cents per pound, the net social benefits range from $3.2 million to $174.5 million per year, according to ERS estimates (table 1). However, smaller volume plants and plants without onsite irradiation facilities are likely to incur higher irradiation treatment costs. At a cost of 5 cents per pound, industry costs could outweigh social benefits by $57.5 million at the lower range of estimated social benefits.

What's Ahead?

Despite scientific evidence of the effectiveness and safety of irradiation and regulatory approval of the process for specific uses, few food processors and retailers are offering irradiated products. Some processors and retailers question whether consumers will buy irradiated products and fear boycotts threatened by groups opposed to food irradiation.

Although irradiating ground beef would likely reduce foodborne illness and extend shelf-life, demand may be insufficient. To date, the market for irradiated pork has not developed, while irradiated poultry is purchased primarily by selected healthcare and foodservice establishments.

Adoption of irradiation by the food industry hinges on sufficient consumer acceptance. Also, producers, retailers, and foodservice operators will compare the cost of irradiation with other technologies for reducing pathogen contamination of foods (see "Innovative Technologies Could Improve Food Safety" elsewhere in this issue). If these factors bear out in favor of irradiation, then the food industry may further adopt the technology.

References

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